

(19)日本国特許庁(J P)

(12) 公 開 特 許 公 報 (A)

(11)特許出願公開番号

特開平5-114529

(43)公開日 平成5年(1993)5月7日

(51)Int.Cl.⁵

H 0 1 F 41/12

識別記号

庁内整理番号

F I

技術表示箇所

D 8935-5E

審査請求 未請求 請求項の数1(全 3 頁)

(21)出願番号 特願平3-275230

(22)出願日 平成3年(1991)10月23日

(71)出願人 000003078

株式会社東芝

神奈川県川崎市幸区堀川町72番地

(72)発明者 吉田 三郎

三重県三重郡朝日町大字繩生2121番地 株

式会社東芝三重工場内

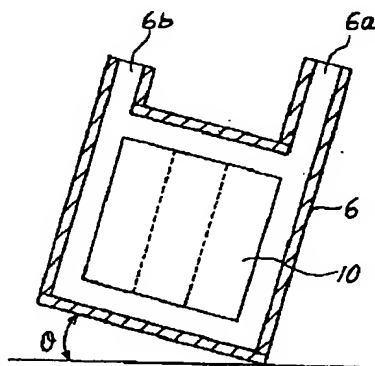
(74)代理人 弁理士 則近 憲佑

(54)【発明の名称】 樹脂モールドコイルの製造方法

(57)【要約】

【構成】 コイル素子体10は軸方向に沿った樹脂含浸路を周方向に間隔をおいた2カ所に有する。このコイル素体10を、2カ所の樹脂含浸路が上下方向に位置するようにモールド金型6内に傾斜させて配置し、この状態で樹脂モールドする。

【効果】 モールド金型6内に充填された樹脂は、液面上昇に伴い、一方の樹脂含浸路からコイル素体10内に流入し電線の巻回間に形成された周方向の隙間を通過して他方の樹脂含浸路から流出する。これにより樹脂がコイル素体10内にくまなく行き渡るため樹脂未含浸部が形成されない。しかも樹脂含浸路を周方向の2カ所に設けるだけでよいので、コイル製作の作業性がよく外形寸法も周方向全体にわたって大きくなることのない。



THIS PAGE BLANK (USPTO)

【特許請求の範囲】

【請求項1】 軸方向に沿った樹脂含浸路を有するコイル素体をモールド金型内に収納して樹脂モールドする樹脂モールドコイルの製造方法において、前記コイル素体の樹脂含浸路を周方向に間隔をおいた2ヶ所に設け、この2ヶ所の樹脂含浸路が上下方向に位置するように前記コイル素体を傾斜させて配置し、この状態で樹脂モールドすることを特徴とする樹脂モールドコイルの製造方法。

【発明の詳細な説明】

【0001】

【産業上の利用分野】 本発明は合成樹脂の含浸性を向上させた合成樹脂モールドコイルの製造方法に関する。

【0002】

【従来の技術】 一般に計器用変成器に用いられる樹脂モールドコイルは低圧コイルの外周にコイル間絶縁物を介して高圧コイルを配置してなるコイル素体を合成樹脂によりモールドして構成されている。低圧コイルは高圧コイルに比べ端子間電圧が低く電流容量が大きいので、高圧コイルに比べて大きい断面積の電線が用いられ、また一層当りの電圧も低いことからコイル層間には絶縁物を介在させていないが、高圧コイルは低圧コイルに比べて端子間電圧が高く、一層当りの電圧も高くなることから層間絶縁物を介して構成されている。この層間絶縁物あるいはコイル間絶縁物は例えばポリエステルフィルムのようなフィルム質絶縁物を用いており、これにより繊維質絶縁物を用いた場合に比べて絶縁耐力に優れた樹脂モールドコイルが得られる。

【0003】

【発明が解決しようとする課題】 ところで上記のような樹脂モールドコイルは約2 Torrで合成樹脂5の真空モールド作業が行なわれる。しかしながら樹脂モールドした際に低圧コイルには樹脂が十分に含浸するが、高圧コイルには樹脂未含浸部が形成されやすいという問題がある。これは低圧コイルは層間絶縁物もなく、また太い電線を用いているので、電線が全周にわたって密着することがなく隙間が形成され、この隙間より合成樹脂が低圧コイル内へ充填されるのに対し、高圧コイルは電線を多層に巻回してなり、そのコイル形成時に電線に引張力をかけて巻回するので、巻回層が増加するにつれてコイル内部に締付力が蓄積され、電線と層間絶縁物と接する面も固く接触しているために樹脂含浸のための隙間が形成されにくく、また絶縁物がフィルム質のため毛細管現象による含浸が期待できないという事情による。

【0004】 この場合高圧コイル層間に軸方向に沿うスペーサを周方向に間隔をおいて配置して隙間を形成する（例えば特開昭58-42213号公報）ことも考えられているが、多数のスペーサを介在させる作業に手間が掛かり、しかもコイルの外形寸法が大きくなり、使用する樹脂量も多くなって重量の増大を招く欠点がある。こ

の発明は上記欠点を除去するためになされたもので、コイル中に樹脂未含浸部を形成することなく、しかも作業性がよく外形寸法の増大を招くことのない樹脂モールドコイルの製造方法を提供することを目的とする。

【0005】

【課題を解決するための手段】 本発明は、軸方向に沿った樹脂含浸路を有するコイル素体をモールド金型内に収納して樹脂モールドする樹脂モールドコイルの製造方法において、前記コイル素体の樹脂含浸路を周方向に間隔をおいた2カ所に設け、この2カ所の樹脂含浸路が上下方向に位置するように前記コイル素体を傾斜させて配置し、この状態で樹脂モールドすることを特徴とする。

【0006】

【作用】 モールド金型内に充填された樹脂は、液面上昇に伴い、一方の樹脂含浸路からコイル素体内に流入し電線の巻回間に形成された周方向の隙間を通して他方の樹脂含浸路から流出することにより樹脂がコイル素体内にくまなく行き渡るので樹脂未含浸部が形成されない。しかも樹脂含浸路を周方向の2カ所に設けるだけでよいので、コイル製作の作業性がよく外形寸法も周方向全体にわたって大きくなることのない。

【0007】

【実施例】 以下本発明の一実施例を図面を参照して説明する。図2は樹脂モールドするコイル素体の断面図であり、低圧コイル1の外周にポリエステルフィルムのようなフィルム質絶縁物からなるコイル間絶縁物2を介して高圧コイル3を巻回してなる。高圧コイル3は電線を多層に巻回して構成され、各層間にポリエステルフィルムのようなフィルム質絶縁物からなる層間絶縁物4を介在させている。この層間絶縁物4は図3及び図4に示すように巻回層のほぼ半周分の大きさを有するフィルムを2枚用いて巻回方向端部が重なるように巻き付けて構成されている。これにより高圧コイル3には周方向の2カ所に間絶縁物4の重なり部による隙間が形成され、この隙間が軸方向に沿う樹脂含浸路5を構成する。

【0008】 そして図1に示すようにこのコイル素体をモールド金型6内に収納し、図示しない加熱炉内にモールド金型6を所定の角度 θ 傾けて配置してコイル素体の2カ所の樹脂含浸路5、5が傾斜した状態で上下方向に位置した状態となるようにする。次いでモールド金型6内を真空に引き注入口6aから樹脂を注入する。すると樹脂はコイル素体の下方の樹脂含浸路5からコイル素体内に流入し、電線の巻回間に形成された、周方向に沿う楔状の隙間を通して上方の樹脂含浸路5に流入していく。このような経路で樹脂の液面の上昇に伴いコイル素体の軸方向に沿って順次樹脂の含浸が行われる。樹脂はモールド金型6の脱気口6aに達するまで注入される。樹脂をモールド金型6内に充填した後、モールド金型6を加熱して樹脂を硬化させる。樹脂の硬化後、モールド金型6を加熱炉から取り出しモールド金型6を分解して

THIS PAGE BLANK (USPTO)

3

樹脂モールドコイルを製造する。

【0009】このようにすれば、コイル素体は樹脂含浸路5、5を2カ所形成すればよいので、コイルの外形寸法が周方向全体にわたって大きくなることはなく、しかもコイルの製作作業も大きく損なわれない。また樹脂の含浸が円滑に行われるので、樹脂未含浸部が形成されることもない。

【0010】尚上記実施例では2枚のフィルムを用いて層間絶縁物を形成した場合について説明したが、例えば1枚のフィルムを用いてこれを巻回して両端部を重ねるとともにその重ね合わせ部に対しコイル軸心を中心として点対象の位置にスペーサを介在させてこの重ね合わせ部およびスペーサによってコイル素体内の各層間に2カ所の樹脂含浸路を形成するようにしてもよい。

【0011】

【発明の効果】本発明は以上説明したように樹脂含浸路*

4

*を2カ所に形成したコイル素体を傾斜させて樹脂モールドするようにしたので、コイル素体の製作作業が複雑になることなく、しかも外形寸法も全周にわたって大きくなることもなく、樹脂未含浸部が形成されなくて絶縁欠陥のない樹脂モールドコイルを製造することができる。

【図面の簡単な説明】

【図1】本発明によるコイル素体を樹脂モールドしている状態を示す断面図

【図2】本発明で用いたコイル素体を示す断面図

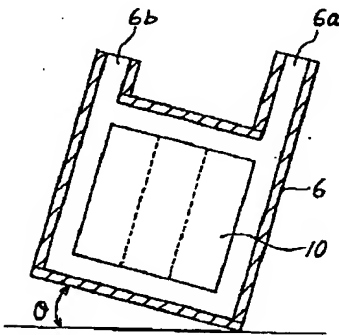
【図3】コイル素体の要部を拡大して示す断面図

【図4】コイル素体に用いられている層間絶縁物を示す斜視図

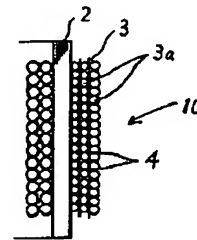
【符号の説明】

1は低圧コイル、2はコイル間絶縁物、3は高圧コイル、4は…高圧銅線、5は樹脂含浸路、6はモールド金型、6aは注入口、6bは脱気口である。

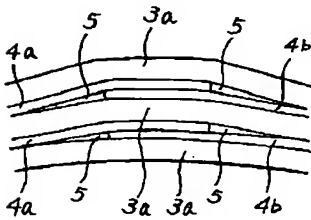
【図1】



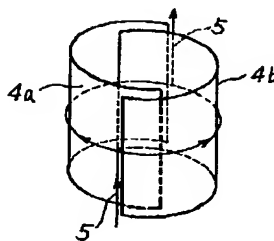
【図2】



【図3】



【図4】



THIS PAGE BLANK (USPTO)

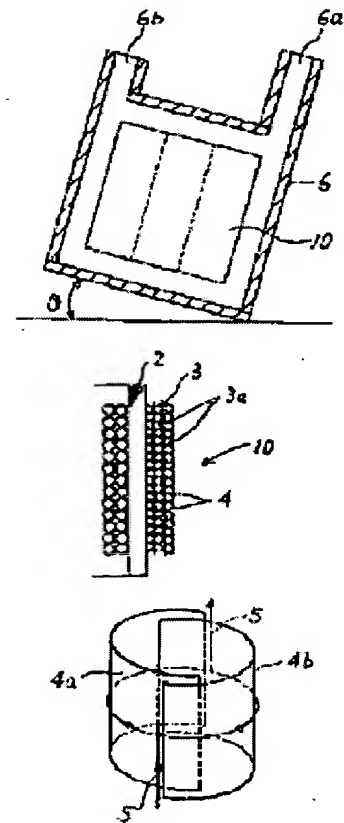
MANUFACTURE OF RESIN MOLD COIL

Patent number: JP5114529
Publication date: 1993-05-07
Inventor: YOSHIDA SABURO
Applicant: TOSHIBA CORP
Classification:
 - international: H01F41/12
 - european:
Application number: JP19910275230
Priority number(s):

Abstract of JP5114529

PURPOSE:To prevent the formation of a part in a coil which part has not yet been impregnated with resin, and evade the increase of outer size, by forming resin impregnation paths of a coil element at two parts having an interval in the peripheral direction, arranging the coil element slantingly in the manner in which the two resin impregnation paths are positioned in the vertical direction, and performing resin mold.

CONSTITUTION:A high voltage coil 3 is wound around the outer periphery of a low voltage coil 3, via inter-coil insulator 2 composed of film insulator. Gaps of the overlapping of insulator 4 is formed at two parts in the peripheral direction of the high voltage coil 3. Said gaps constitute resin impregnation paths 5 along the axial direction. The coil element is accommodated in a metal mold 6, which is arranged in a heating furnace so as to be inclined by a specified angle theta. The resin impregnation paths 5, 5 in the two parts of the coil element are inclined to be positioned in the vertical direction. The inside of the metal mold 6 is vacuumized, and resin is injected from an injection port 6a. The impregnation of resin is performed along the axial direction of the coil element as the liquid level rises.



THIS PAGE BLANK (USPTO)

[Claim(s)]

[Claim 1] The manufacture approach of the resin mold coil characterized by to establish the resin sinking-in way of said coil element assembly in two places which set spacing to a hoop direction in the manufacture approach of the resin mold coil which contains and carries out the resin mold of the coil element assembly which has a resin sinking-in way in alignment with shaft orientations into mold metal mold, to make said coil element assembly incline, to arrange so that this two resin sinking-in way may be located in the vertical direction, and to carry out resin mold in this condition.

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the manufacture approach of the synthetic-resin mold coil which raised the impregnating ability of synthetic resin.

[0002]

[Description of the Prior Art] The resin mold coil generally used for a meter transformer carries out the mold of the coil element assembly which comes to arrange a high tension coil through the insulating material between coils to the periphery of a low-tension coil with synthetic resin, and is constituted. The electric wire of the large cross section is used compared with a high tension coil, and since the electrical potential difference of a hit is also still lower, the low-tension coil is not making the insulating material intervene between coil layers, since the electrical potential difference between terminals is low and current capacity is large compared with a high tension coil, but since the electrical potential difference between terminals is high and the electrical potential difference of a hit also becomes high further compared with a low-tension coil, the high tension coil is constituted through the layer insulation object. This layer insulation object or the insulating material between coils uses a nature insulating material of a film like polyester film, and the resin mold coil which was excellent in dielectric strength compared with the case where this uses a fiber insulating material is obtained.

[0003]

[Problem(s) to be Solved by the Invention] By the way, as for the above resin mold coils, the vacuum mold activity of synthetic resin 5 is done by about 2 Torr(s). However, although resin fully sinks into a low-tension coil when resin mold is carried out, there is a problem that resin the non-sunk in section is easy to be formed in a high tension coil. Since a low-tension coil does not have a layer insulation object, either and uses the thick electric wire, this Since an electric wire does not stick over the perimeter, a clearance is formed, a high tension coil comes to wind an electric wire around a multilayer to filling up with synthetic resin into a low-tension coil from this clearance and it winds around an electric wire at the time of that coil formation, applying tensile force It is based on the situation that clamping force is accumulated in the

interior of a coil as a winding layer increases, the clearance for resin sinking in is hard to be formed since the field which touches an electric wire and a layer insulation object also touches firmly, and sinking in by capillarity is not expectable since an insulating material is the quality of a film.

[0004] In this case, although what (for example, JP,58-42213,A) the spacer in alignment with shaft orientations is set to a hoop direction, spacing is arranged, and a clearance is formed also for between high tension coil layers is considered, the activity between which many spacers are made to be placed takes time and effort, and there is a fault which the dimension of a coil moreover becomes large, and the amount of resin to be used also increases, and causes increase of weight. It aims at offering the manufacture approach of a resin mold coil that moreover workability does not cause increase of a dimension well, without having been made in order that this invention might remove the above-mentioned fault, and forming resin the non-sunk in section into a coil.

[0005]

[Means for Solving the Problem] This invention establishes the resin sinking-in way of said coil element assembly in two places which set spacing to the hoop direction, makes said coil element assembly incline, arranges it so that this two resin sinking-in way may be located in the vertical direction, and it is characterized by to carry out resin mold in this condition in the manufacture approach of the resin mold coil which contains and carries out the resin mold of the coil element assembly which has a resin sinking-in way in alignment with shaft orientations into mold metal mold.

[0006]

[Function] Since resin spreads everywhere in a coil element assembly by flowing out of the resin sinking-in way of another side through the clearance between the hoop directions which the resin with which it filled up in mold metal mold flowed in the coil element assembly from one resin sinking-in way with the rise of an oil level, and were formed between winding of an electric wire, resin the non-sunk in section is not formed. And since what is necessary is just to establish a resin sinking-in way in two places of a hoop direction, a dimension does not become [the workability of coil manufacture] good greatly over the whole hoop direction, either.

[0007]

[Example] One example of this invention is explained with reference to a drawing below. Drawing 2 comes to wind a high tension coil 3 through the insulating material 2 between coils which is the sectional view of the coil element assembly which carries out resin mold, and becomes the periphery of a low-tension coil 1 from a nature insulating material of a film like polyester film. A high tension coil 3 winds an electric wire around a multilayer, and is constituted, and the layer insulation object 4 which consists of a nature insulating material of a

film like polyester film between each class is made to intervene. It twists and this layer insulation object 4 is constituted so that the two winding direction edges may lap using the film of a winding layer which has the magnitude gone half round mostly, as shown in drawing 3 and drawing 4. The clearance by the lap section of the between insulating material 4 is formed in a high tension coil 3 by this at two places of a hoop direction, and this clearance constitutes the resin sinking-in way 5 in alignment with shaft orientations.

[0008] And this coil element assembly is contained in the mold metal mold 6, and it is made to be in the condition of having been located in the vertical direction after predetermined include-angle theta. Leaned the mold metal mold 6, it has arranged it in the heating furnace which is not illustrated and two resin sinking-in ways 5 and 5 of a coil element assembly had inclined, as [show / in drawing 1]. Subsequently, the inside of the mold metal mold 6 is lengthened to a vacuum, and resin is poured in from inlet 6a. Then, resin flows in a coil element assembly from the resin sinking-in way 5 of the lower part of a coil element assembly, and flows into the upper resin sinking-in way 5 through the wedge-shaped clearance along a hoop direction formed between winding of an electric wire. In accordance with the shaft orientations of a coil element assembly, sinking [of resin] in is performed one by one with the rise of the oil level of resin in such a path. Resin is poured in until it reaches degassing opening 6a of the mold metal mold 6. After being filled up with resin in the mold metal mold 6, the mold metal mold 6 is heated and resin is stiffened. After hardening of resin, the mold metal mold 6 is picked out from a heating furnace, the mold metal mold 6 is disassembled, and a resin mold coil is manufactured.

[0009] If it does in this way, since a coil element assembly should just form two resin sinking-in ways 5 and 5, the dimension of a coil will not become large over the whole hoop direction, and, moreover, manufacture of a coil will not be spoiled greatly. Moreover, since sinking [of resin] in is performed smoothly, resin the non-sunk in section is not formed.

[0010] In addition, although the above-mentioned example explained the case where a layer insulation object was formed using the film of two sheets. For example, while winding this using the film of one sheet and piling up both ends. A spacer is made to be placed between the locations of a point pair elephant focusing on a coil axial center to that superposition section, and you may make it form two resin sinking-in ways between each class in a coil element assembly with this superposition section and spacer.

[0011]

[Effect of the Invention] The resin mold coil which resin the non-sunk in section is not formed and does not have an electrical insulation defect can be manufactured without moreover a dimension also becoming large over the perimeter, without manufacture of a coil element assembly becoming complicated, since this invention makes the coil element assembly which

formed the resin sinking-in way in two places incline and was made to carry out resin mold, as explained above.

[Brief Description of the Drawings]

[Drawing 1] The sectional view showing the condition of carrying out the resin mold of the coil element assembly by this invention

[Drawing 2] The sectional view showing the coil element assembly used by this invention

[Drawing 3] The sectional view expanding and showing the important section of a coil element assembly

[Drawing 4] The perspective view showing the layer insulation object used for the coil element assembly

[Description of Notations]

For the insulating material between coils, and 3, a high tension coil and 4 [1 / a low-tension coil and 2]. -- For high-pressure copper wire and 5, a resin sinking-in way and 6 are [an inlet and 6b of mold metal mold and 6a] degassing openings.

**This Page is Inserted by IFW Indexing and Scanning
Operations and is not part of the Official Record**

BEST AVAILABLE IMAGES

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images include but are not limited to the items checked:

- ☐ BLACK BORDERS
- ☐ IMAGE CUT OFF AT TOP, BOTTOM OR SIDES
- ☒ FADED TEXT OR DRAWING
- ☒ BLURRED OR ILLEGIBLE TEXT OR DRAWING
- ☐ SKEWED/SLANTED IMAGES
- ☐ COLOR OR BLACK AND WHITE PHOTOGRAPHS
- ☐ GRAY SCALE DOCUMENTS
- ☒ LINES OR MARKS ON ORIGINAL DOCUMENT
- ☒ REFERENCE(S) OR EXHIBIT(S) SUBMITTED ARE POOR QUALITY
- ☐ OTHER: _____

IMAGES ARE BEST AVAILABLE COPY.

As rescanning these documents will not correct the image problems checked, please do not report these problems to the IFW Image Problem Mailbox.

THIS PAGE BLANK (USPTO)